

## **Development and Support for the USGODAE Server**

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### **LONG-TERM GOALS**

The USGODAE Monterey Data Server is envisioned as the hub for US and international GODAE projects. To meet this goal, the data server must fulfill three major roles. First, the server must act as a data server, providing reliable access to observational data and surface forcing fields to drive GODAE ocean models. Second, the server must be part of a framework to access and compare ocean model, or demonstration product output; so researchers can compare, analyze and validate ocean models. Finally, the server must have well-organized, easily accessible documentation to simplify data usage, and provide details for the many GODAE and US GODAE projects.

The USGODAE Monterey Data Server should eventually become the first stop for users seeking US GODAE data, documentation, or model output. Through USGODAE, users will be able to locate data and documentation hosted both on and off the server. The Asia Pacific Data Research Center (ADPRC), which is hosted by the International Pacific Research Center (IPRC) at the University of Hawaii, will function as a companion data center in support of GODAE climate forecasts. Over time, the two servers will be configured to appear as a single virtual data service for GODAE users.

### **OBJECTIVES**

GODAE provides the context for bringing existing ocean data assimilation developments and applications together to accelerate improvements to models and transition to the operational environment. Ready access to quality-controlled observations is a necessity to achieve this. The USGODAE Monterey Data Server is designed to satisfy this requirement, and at the same time to promote interactions between observationalists and data assimilators and between different assimilation groups. These interactions are needed to share and extend the knowledge base that will lead to improved operational ocean models and products.

The USGODAE Monterey server should be a prototype for data assembly centers in the Integrated Ocean Observing System (IOOS). To this end, the data server project must be closely involved with the projects developing, implementing, and promoting community data serving standards. This approach not only benefits the data server, by making data available through standard protocols and formats, but also helps promote the standards by serving data sets of interest to GODAE participants, and the broader oceanographic community. Furthermore, it aids the development of data serving

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software; since the standard servers must be adapted to the wide range of formats hosted on USGODAE, and made to work with the USGODAE near real-time data streams.

## **APPROACH**

The Monterey data server provides a stable, high reliability, high availability platform for data hosting. Since the servers are housed in the FNMOC operational data center, with 24x7 monitoring and support, users are guaranteed fast, dependable access to data and documentation. The server hosts a wide range of observational data, surface forcing fields, and model output, of interest to GODAE participants and the broader oceanographic community. Data discovery is simplified by an easy to use Web application that allows key-word searches, or direct selection from a data catalog. The discovery application provides users with complete access, usage, and documentation information for each data set.

One of the main challenges of hosting numerous data collections in several different formats is supplying users with the tools and documentation to retrieve and use the data effectively. The first step to solve this problem is providing complete documentation, and links to any available support programs through the data discovery application. Also, the server uses a number of Web applications, including Live Access Server (LAS), to generate quick on-line preview images of almost all of the data hosted on USGODAE. Finally, the server follows community data serving standards, like those specified in the National Virtual Ocean Data System (NVODS) and the Integrated Ocean Observing System Data Management and Communications (IOOS/DMAC) scheme. Consequently, users have a wide range of well-documented interfaces, APIs, and applications to access and use USGODAE data.

### **Key Individuals:**

*Program/Data Manager, Phil Sharfstein:* Provides oversight of the server, including assurance of correct and reliable operation of the server and its associated Web Site, documentation, evaluation of server functionality and utility, and coordination of work by supporting personnel at FNMOC and PMEL. Interacts with GODAE users to publicize and promote use of this data and respond to all requests for information from users. Performs outreach and interaction with the GODAE science community to identify and install new data sets on the server. Liaises with other data serving sites to ensure seamless presentation and minimize duplication. Promotes the server to the GODAE and general oceanographic communities.

*Project Management at FNMOC, Czac Panek, Dave Dimitriou:* Provides project management functions including, but not limited to, contract development, award, and monitoring, procurement, inter/intra-departmental coordination and liaison. Provide general management support to further the operational transition of the US GODAE Server.

*Systems Software/Hardware Support, FNMOC Staff:* Ensures 24x7 operations of the server, including proper operation of fail over and backup contingencies and data archival/retrieval functions and system security.

*Argo GDAC Manager, Mark Ignaszewski, Assistant Argo GDAC Manager, Greg Hoisington:* Installs and maintains the Argo Global Data Assembly Center (GDAC) software on the Monterey server.

Monitors GDAC operations on the Monterey server and ensures GDAC data integrity is maintained on the server.

*GODAE Web Site Support, FNMOC Staff:* Maintains and supports the GODAE Server Web site.

*Visualization and Data Distribution Software Development and Support, Steve Hankin and staff members of the Thermal Modeling and Analysis Project (TMAP) at PMEL:* Provides software to enable uniform, interoperable browsing and comparison of complex curvilinear model outputs and data. Develops and tests initial prototypes of model inter-comparison framework to connect collaborating GODAE modelers. Provides liaison and coordination with the US Integrated Ocean Observing System as chair of the Data Management and Communications (DMAC) Steering Committee of IOOS. Provides liaison and coordination with the National Virtual Ocean Data System as a member of the NVO DS Executive Committee. Provides liaison and coordination with the APDRC GODAE climate data server in Hawaii.

## **WORK COMPLETED**

*Argo* - There are now over 175,000 profiles on-line from nine Data Assembly Centers (DACs). This includes over 22,000 delayed-mode, scientific quality controlled profiles. Major improvements to GDAC processing to improved the robustness of Argo data serving and data synchronization with the French GDAC.

*Hardware Upgrades* - As part of the planned hardware upgrade, two 6 Terabyte Adaptec Snap 18000 Network Attached Storage (NAS) Servers have been installed as the primary storage volumes. The Snap 18000 is expandable to 30 Terabytes of storage. The NAS units are configured as one primary NAS and one near-line synchronized backup NAS. This provides backup and failover in a unit that is independent of the server architecture.

*New Data Sets* - Several new data sets have been added to the server and integrated with the USGODAE data serving applications, including: World Ocean Atlas 2001, Navy GDEM Climatology, a custom FNMOC High resolution SST/Sea Ice Analysis run as a contribution to GHRSSST, and a custom FNMOC High Resolution Ocean Analysis run as a contribution to GODAE.

*Live Access Server (LAS)* - The LAS *in-situ* database, including Argo, has been re-architected. The new database provides more compact storage, faster retrieval, and better compatibility with the Live Access Server. Major enhancements to the LAS data access software include: 1) automated creation of a THREDDS (Thematic Realtime Environmental Data Distribution Service) catalog for further integration with the large Unidata-supported data tools community; 2) greatly improved user control over “options” allowing users to customize files and graphics obtained through LAS; 3) a robust Search capability, allowing users quickly to locate datasets of interest; 4) a “batch” capability that enables very large data subsets to be delivered through the same consistent interface as interactive requests; and 5) the release of FDS (Ferret Data Server), a tightly integrated OPeNDAP Server providing server-side regridding (and analysis) capabilities for all data sets hosted in LAS. FDS is the foundation of the powerful, new model intercomparison framework to be completed in FY06. A new GODAE model intercomparison LAS has been configured based upon the latest LAS code and heavily using the configurability options. It is in the final stages of evaluation prior to being re-hosted from its development environment to the Monterey GODAE server.

*Miscellaneous* - All USGODAE data sets are cataloged on NASA's Global Change Master Directory (GCMD). This provides users an alternate method of searching the Server's data holdings, and integrates USGODAE data with the over 15,000 data sets cataloged by GCMD.

## **IMPACT/APPLICATIONS**

The USGODAE server provides the framework for many projects essential to the success of GODAE, and the US efforts in GODAE. The server and LAS are positioned to be the focus point for several projects, including the US GODAE model intercomparison, GODAE Ocean QC intercomparison and MERSEA. As the central node in these projects, the data server project is in a unique position to develop methods for researchers to interact and compare oceanographic data over the Internet.

As a prototypical IOOS data assembly center (data server), USGODAE will help shape the future of major data serving initiatives like NVODS and NOMADS (see below).

## **RELATED PROJECTS**

*National Virtual Ocean Data System (NVODS)*: The USGODAE Server is part of NVODS and follows the community data serving standards specified by NVODS. Also, the USGODAE data server project contributes to the development and specification of NVODS standards. LAS provides uniform georeferenced visualization, subsetting and comparison for NVODS.

*NOAA Operational Model Archive and Distribution System (NOMADS)*: The Monterey server serves as a prototype for public data servers in NOMADS. LAS is the principal visualization engine for NOMADS.

*Thematic Real Time Environmental Data Distribution System (THREDDS)*: The data server project is active in the development of THREDDS data catalogs, and uses THREDDS catalogs as one method of data discovery on the servers.

*Cooperative Opportunity for NCEP Data Using IDD Technology (CONDUIT)*: The USGODAE Server distributes data through UNIDATA's IDD system. The project is also involved with the planning and development of the CONDUIT system and software.

*International Pacific Research Center (IPRC) GODAE Climate Server*: Creating a blended real-time/climate GODAE site using LAS and OPeNDAP technology.

*Argo*: USGODAE is one of two Global Data Assembly Centers (GDACs), hosting the complete set of quality controlled Argo data.

*Tagging Of Pacific Pelagics (TOPP)*: The project acts in an advisory role for TOPP, assisting by specifying data formats, quality control, and serving needs of the data assimilation community.

*NRL/HYCOM/ECCO/NSIPP (US GODAE R&D Systems)*: The server provides data to force ocean models. Model outputs are also available through the USGODAE Modelers LAS.

*GODAE High Resolution Sea Surface Temperature (GHRSSST):* The server provides data to GHRSSST to create ocean products. Eventually, the USGODAE server will host GHRSSST products, and may host a GHRSSST data assembly center.

*GODAE QC Project:* The USGODAE server hosts the Quality Control (QC) project, providing data sets, comparison results, and documentation.

*GODAE Surface Forcing Intercomparison Project:* USGODAE provides surface forcing fields from FNMOC for the Surface Forcing Intercomparison Project.

## **PUBLICATIONS/OUTREACH**

“The USGODAE Monterey Data Server”, Presentation, 2005 Annual Meeting of the American Meteorological Society.

“USGODAE Monterey Data Server”, Poster Presentation, Digital Library for Earth Systems Education Data Services 2005 Workshop.

Invited Participant: Digital Library for Earth Systems Education Data Services 2005 Workshop.

Participant: "International Argo Steering Team Meeting", February 2005.

Co-Sponsor Special Focus Session: “Cyberinfrastructure for Earth Systems Science”, 2004 Fall Meeting of the American Geophysical Union.

“The USGODAE Monterey Data Server”, Presentation, 2004 Fall Meeting of the American Geophysical Union.

“USGODAE Monterey Data Server”, Poster Presentation, GODAE International Symposium, St. Petersburg, FL, 2004.

"Status of the USGODAE Monterey Data Server", Presentation, 2004 USGODAE Steering Team Meeting.

Participant: "US Argo Science Panel Meeting", December 2004.

Co-chair: "International Argo Data Management Team Meeting", September 2004.